Project Athena Overview

Project Athena

This document is intended for faculty members who wish to learn what Project Athena provides and in what ways its facilities might be useful in teaching. It is abridged and updated from the document *Project Athena Facilities - an Overview for Faculty* by Jerome H. Saltzer, dated March 18, 1988. It is divided into the following sections:

I. The Design of the System

The primary component of Project Athena is a network-attached low-end engineering workstation. By the end of the Fall '89 semester there will be close to 1000 such workstations, both DEC VAXstations and IBM RTs, deployed in public clusters and in departmental facilities.

Clients and Servers.
The software that comes with an Athena workstation uses a "client/server" model, which means that the workstation, acting as a client, obtains many services from other computers, acting as remote servers over the network. For example, private mail accumulates at a post office server until the addressee picks it up; files to be printed on a laser printer are queued on a print server to assure orderly service and accounting.

File service.
The most important service is remote file storage. Computers with large disks located in a few machine rooms around campus act as file servers. They provide a small private file storage "locker" for each user, as well as course and development lockers for faculty to use in teaching and in developing instructional materials. When a user logs in at an Athena workstation his or her private locker is automatically attached to the file system of the workstation in a way that makes that user's files appear to actually reside there. The user may also explicitly attach any other locker or class library that is on any Athena server. The creator of each file has control over who has access to its contents, and can explicitly control who has privileges to read or execute it, and who may modify it.

Backup.
Project Athena provides limited backup against disk failure in its file servers by making a complete copy of the contents of each disk approximately once each week. If a serious disk failure occurs, the users whose files were stored on that disk may lose anywhere

from a few hours' to a week's work, depending on when the most recent backup copy was made. Users who have files that would be hard to reconstruct are encouraged to provide additiional backup by making a copy on a 1.2 Megabyte high-density 5 1/4 inch diskette, which is the standard removable medium on most Athena workstaions. Faculty with private workstations should also be aware that there is no automatic backup of the files stored locally on their workstations. However, keeping copies of a valuable file in at least two places, such as one on a private workstation and one in a locker on a file server, would be expected to be a moderately safe and reliable approach.

RVD.
 A second network-based storage service known as Remote Virtual Disk (RVD) provides high performance access to shared large read-only libraries. Most of the system software actually resides on such RVD storage servers. Placing it there rather than on the workstation provides economy of storage and also the ability to perform software updates by a central change, rather than by visiting every workstation.

Authentication.
When a user logs in to an Athena workstation giving a name and a password, the authentication system, named Kerberos, provides credentials for that user on which all other network services rely. The credentials, consisting of the user's name and related information encrypted into a bit string called a ticket, serve as hard-to-forge evidence of the workstation user's identity. As an example, the post office demands a valid Kerberos ticket naming the addressee before it will release that addressee's mail to a workstation.

Electronic Mail, Post Offices, and Zephyr.
Some faculty find that electronic mail is one of the most useful tools available to augment the educational environment. Every user of the system has a registered name for logging in and for receiving mail. A set of post office servers collect mail for users; when an Athena user logs in at a workstation, a mail management system is available to collect mail from the post office, store it in the user's private file system, and reply or send new messages. Throughout Project Athena, mail is addressed simply with the name of the user or of a mailing list, which is a user-maintained list of user names. The Athena mail system interconnects with the electronic mail exchange system used throughout MIT. The mail system also interconnects with many outside mail systems. All Athena mailboxes appear from the outside to be on a single computer named "athena.mit.edu."

The "Zephyr" notification system provides delivery of short-lived notices to users currently logged in at a workstation. Notices may be sent, for example, between individual users, by a teaching assistant to currently active class members, from a system operator to all the users in one building, or from a post office to a user to announce arrival of a new piece of electronic mail.

Other Servers.
To use a network service, the client must discover which Athena computer acts as host for that service. An online name lookup service, Hesiod, provides a comprehensive directory of other network services. When a user logs in, the workstation asks Hesiod for directory information about the user and is which file server contains that user's locker

and where the user's mail can be picked up. Similarly, a student attaches a class locker by giving its name; the attach command invokes Hesiod to learn which fileserver exports that file system. Moira, the Service Management System, is the set of tools by which Hesiod's database is managed.

II Hardware Facilities

Printing Facilities.
Project Athena provides about 60 laser printers in various locations around the campus, and one high-volume laser printer on the second floor of MIT Bulding 11. In additiona to multi-font text these printers can produce copies of graphic images directly from the display of an Athena workstation. Beginning with the Fall, 1989 academic term, each Athena user will have a quota of 500 printed pages per term. There will be no fee for users whose printing usage falls under this allotment. Allotments beyond the base quota will be available, but for a fee. From analysis of last year's usage, the base allotment should suffice for the majority of users. Because of implementation requirements, fees will be waived until after the Fall, 1989 term.

Special Classrooms.
An Electronic Classroom in Building 37 with 20 workstations allows faculty to try ideas for direct classroom use. Additional lecture halls (35-225 and 34-101) each have an Athena workstation attached to a projection display for lecture demonstrations.

Special Facilities: Color and Video.
A small cluster of Athena workstations located in the "fishbowl" on the first floor of MIT Building 11 is equipped with videodisk equipment, cable TV connections, and special color displays that permit work with moving video on the same screen used for computer display. A small advanced development group provides support to faculty who are experimenting with this hardware. Faculty interested in exploring possibilities of use of this limited facility should contact the Athena Faculty Liaisons for more information.

Access to other MIT computers.
The MIT Cray supercomputer and the IBM mainframe, MITVMA, may both be accessed from an Athena workstation. The user would log into Athena as usual, and then give the command 'telnet ed' to connect to the Cray or 'telnet mitvma' to connect to the IBM mainframe. For information about using the Cray, contact the Administrative Officer at the Supercomputer Facility (x3-8033, Room 11-124A). For information about MITVMA, contact I.S. User Accounts *********.

III Software Facilities

The Athena system presents its users with a library of ready-to-use tools and application packages, under the supervision of the UNIX operating system.

The X Window System.
The X Window System provides two major features. First, it allows the user to organize a display screen into several separate sections, called windows, each of which can display the result of a separate activity. For example, one window can contain the graphical output of a simulation program, while a second window contains the text of a report the user is preparing that analyzes the simulation; the user can open a third window to look up a word in a dictionary or some other library reference, then go back to writing the report with the result of the reference lookup still on the screen. The second major feature of the X Window System is that it provides a machine-independent application programming interface for information display, facilitating the ability to transport software that has a graphic interface from one vendor's platform to another's.

UNIX commands.
UNIX provides a command interpreter, known as the "shell," and a large library of standard commands to create, name, list, sort, edit, and compare files. One of the standard shell's features is that a user may express a chain of commands, arranging that the data output of one program be the data input to the next. Although the method of expressing such sequences is somewhat cryptic to a beginner, it is this feature that is usually contemplated when someone describes UNIX as having a "powerful" command language. The document "Athena Basics" lists the commands that are needed for getting started. The trade press has produced several popular books of both tutorial and reference material for users of UNIX.

Third-Party Application Packages.
Project Athena augments the standard UNIX library of commands with a set of site-licensed third-party application packages. The most important of these is a text editor named "emacs" (in the gnu-emacs version), probably the most popular editor found on engineering workstations. This editor requires a fair amount of effort to learn, but once mastered it rewards the user with an extremely powerful and easy-to-use facility for creating, rearranging, modifying, and examing text. In addition, a WYSIWYG (What You See Is What You Get) word processor name Andrew Ez, has been imported from Carnegie Mellon University and is available on an experimental basis. We hope to eventually include it as part of our standard Athena software suite.

Other third-party applications include text formatting systems (Scribe and LaTEX), a symbolic algebraic manipulator (Macsyma, currently available only on the VAXstation), a laboratory analysis package (RS/1, currently available only on the VAXstation), a matrix manipulation package (MatLab), and a library of numerical algorithm subroutines (NAG). Information on all the software packages publicly available on Athena is available through On Line Help (see section V below) and a list of these packages is provided with this document.

*********Should we include the software matrix with this document?*******

Programming Languages.
The Athena system provides C, Fortran, Scheme, Kyoto Comon Lisp, and CLU. The "native language" of UNIX is C. Applications written in C can make use of every feature

and library of the system. For that reason, as well as availability of a wide spectrum of debugging tools, most newly-written large applications at Project Athena are done in the C language. In addition to regular and optimizing C compilers, an interpreter named Saber-C provides a significant aid for program developers.

Program Libraries and Toolkits.

Several libraries of application subroutines are part of the standard Athena system; they are intended to make it easier to develop applications. The combination of the UNIX and the X libraries represent an industry standard programming interface that is very widely available; applications that use these two libraries can generally be ported from one UNIX workstation type to another simply by moving the source files and recompiling. In addition, two toolkits intended for rapid evelopment of display-oriented applications are now available; the X Toolkit and the Andrew Toolkit.

Utilities for use in Subjects.

On Line TA (**olta**) is a system by which students in a course may consult with their TAs electronically while logged in and working on an assignment. The Educational On-line System (**eos**), also known as Turn-in/Pickup, allows students to turn in and their instructors to grade and return assignments electronically. Faculty interested in experimenting with either of these two systems should contact the Athena Faculty Liaison Office.

Importing and Exporting Programs.

Project Athena advises importers of majors applications always to attempt to obtain source, rather than binary, implementation, because little snags in binary programs can cause big problems, and also to ensure availability of applications on both IBM and Digital workstations at Project Athena. Applications programs written in the C language, using the UNIX and X libraries, and not intentionally made machine dependent will, once debugged on either variety of Athena workstation, usually port to the other variety of workstation simply by recompiling.

IV Project Athena Administration

Student Registration

Twice each year the registrar provides a list of all registered students to Athena's Service Management System, which enters students not previously registered into a database of prospective users. The User Services staff enters the names of interested faculty into this same data base by hand. When a prospective user decides to become a real user, the procedure is quite simple: sit down at any Athena public workstation, use the mouse to click the button labeled "Register for New Account", and follow the on-screen directions. Over the course of the next 24 hours the Service Management System will prime all of the Athena network services to recognize this user and to provide a home directory for personal files. Problems in registering should be directed to the Athena Accounts Consulting Office (x3 -1325).

Faculty Registration

Any faculty member may register as an Athena user by calling the Athena Faculty Liaison office(x3-0115 or x3-0170), followed by a registration session at a workstation. In addition, if a faculty member wishes to set up a class locker for delivery of homework sets, programs, data, or whatever, a call to that same office can obtain a disk storage locker for that purpose. A project that involves development of new software usually receives a separate allocation of storage space for that development.

Whether or not special resources are needed, contact with the Faculty Liaison office is a good idea, if only to alert that office of your interest. The liaison office maintains a mailing list to inform faculty and developers of changes that may affect their planned use of Athena facilities.

Faculty and Departmental Workstations

Many faculty members have also found it useful to request that their departments pay the cost of installation and network fees for an Athena-granted workstation for use by themselves or their teaching assistants. Such installation requests can be entertained, subject to equipment and network availability. Proposing creation of a department facility may encounter fewer obstacles and lower total cost than proposing installation of several isolated workstations.

Restrictions on Use.

By contract and by policy, Project Athena facilities are for educational use. As is customary with most MIT policies, that policy is broadly interpreted. Students are encouraged to make wide use of the facilities in both curricular and extracurricular applications, within the general guidelines of a statement of "Principles of Responsible Use," which is posted in Project Athena public workstation clusters and on-line. Faculty users are expected to follow the same general guidelines, and to respect the boundary between teaching applications and research, administrative, and personal applications. Software developers should be aware that the MIT policy on software rights has specific provisions on ownership and rights for software developed with substantial use of Athena facilities. **REFERENCE** Finally, faculty should be aware that the security of the Project Athena network storage facilities is not adequate for maintaining privacy of sensitive information such as class grades and letters of recommendation.

V Additional Sources of Information

Accounts and Lockers

To get a faculty account or to have a course or development locker set up, call one of our Faculty Liaison staff:

Anne R. LaVin	x3-0115
Naomi Schmidt	x3-0170

On-Line Help is an extensive on-line Athena documentation set. To browse through it, just type **help** at the Athena prompt. There are also **documentation racks** in each of the clusters with a complete set of reference documentation. Packaged versions of the on-line documents may be purchased at the QuikCopy Center (11-004) and vendor-supplied user manuals and books are available at the Coop.

On-Line Consulting is a system by which you may send a question to a consultant while you are logged in and receive an answer either immediately if it is a simple one or else within a day if it requires more research on the consultant's part. Just type **olc** at the Athena prompt and the program will guide you through the process. If you wish to speak directly with an Athena User Consultant, you may call the Consulting Hotline (x3-4435) or come to the Consulting Office (11-115).

Minicourses, one hour seminars on various aspects of using Project Athena, are given during R/O week as well as during the first six weeks of the term. Special sessions can be scheduled on a departmental basis, in large sections of courses using Athena, or for groups of 6 and more individuals who cannot make regular courses. Contact Gary Dryfoos at x3-0184 to schedule a special session of a minicourse.

The **info** locker contains frequently updated information about Athena such as the status of clusters or printers, the schedule for the Electronic classroom, and the schedule of minicourses. To browse through the files in this locker, you need to first give the command **attach info.** The directory /mit/info will now appear to be on your own workstation and you will be able to read and print any of the files in that directory.

The **instructor** locker contains information useful for faculty using Athena in their courses, including how to set up a course locker and how to use the Educational On-Line System for turnin/pickup. This locker can be accessed in the same manner as described above.

VI Project Athena Minicourses

How to Get Around Athena -
An introduction to Project Athena and Athena workstations. Shows how to get started on the system.

Introduction to Word Processing with Andrew ez
Creating simple documents using a new WYSIWYG screen editor

Basic Word processing
- An introduction to text processing on Athena using Emacs
- Using electronic mail
- Using Athena's laser printers

Advanced Word Processing

- The remaining Emacs fundamentals
- Basic text formatting with Scribe

Advanced Scribe: Reports

The Scribe techniques needed to produce a fully-formatted report, including :
- chapter numbering
- footnotes
- tables
- cross-references
- table of contents
- bibliography

Advanced Scribe: Thesis

How to produce a document that meets all the formatting requirements for an MIT Thesis

RS/1

An electronic lab notebook. Provides facilities for:
- tables
- x,y plots
- 3-D graphs
- data analysis
- curve fittiing

********Gary - is Scribe Math a separate minicourse? Are there any more that I have forgotten?********

VII Athena documents in the "Essential" and "More" series

Essential C	More C: UNIX programming tools
Essential Emacs	More Emacs
Essential Fortran	More Scribe: Report
Essential Messages	More Scribe: Resume
Essential RS/1	More Scribe: MIT Thesis
Essential Scribe	More Unix: The C Shell

********Gary - Is this a complete list? Do you think that listing the entire doc list would be more useful? If so, can I have an up to date copy?********